EMC
TEST REPORT

Report No. : EME-040858
Model No. : WL901
Issued Date : Oct. 1, 2004

Applicant : Kupoint Electric Factory
Juqi Village, Humen, Dongguan, Guangdong, China

Test By : Intertek Testing Services Taiwan Ltd.
No. 11, Ko-Tze-Nan Chia-Tung Li, Shiang-Shan District,
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Project Engineer

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Reviewed By

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Summary of Tests

Remote Controller -Model: WL901
FCC ID: SHG-WL11A

Test	Reference	Results
Conducted Emission of AC Power	15.207	Complies
Radiated Emission test	15.231(b), 15.209	Complies
Measured bandwidth	15.231(c)	Complies

1. General information

1.1 Identification of the EUT

Manufacturer	: Kupoint Electric Factory
Product	: Remote Controller
Model No.	: WL901
FCC ID.	: SHG-WL11A
Frequency Range	: 315MHz
Channel Number	: Single
Frequency of each channel	: 315MHz
Type of Modulation	: ASK
Power Supply (Rx)	: 120Vac, 60Hz
Power Supply (Tx)	: 4.5Vdc
Power Cord	: N/A
Sample Received	: Sep. 2, 2004
Test Date(s)	: Sep. 20, 2004

1.2 Additional information about the EUT

The product consists of a remote-controller and several receivers; the number of receiver can hit 99; user can offer receiver ID NO by themselves and output wattage can be offer by max 10 circuits.

The EUT has only one radio channel 315MHz. It used 99 kinds of different codes for different ID's receiver, but frequency is still 315MHz.

For more detail features, please refer to User's manual as file name "Installation guide.pdf"

1.3 Antenna description

The EUT uses a permanently connected antenna.

Antenna Gain	: 6.30 dBi max
Antenna Type	: PCB Printed
Connector Type	: N/A

1.4 Peripherals equipment

Lamp (450W for WL902; 400W for WL905)

2. Test specifications

2.1 Test standard

The EUT was performed according to the procedures in FCC Part 15 Subpart C Section 15.231.

2.2 Operation mode

The EUT has one transmitter (WL901) and two receivers (WL902 and WL905).
Lamp 450W for WL902; Lamp 400W for WL905

After verifying three setups of transmitter, we found the worst case was occurred at setup 2, so the final test was executed under this condition and recorded in this report.

During all of the tests, the EUT was operated in transmitting continuously.

Once the button releasing, the transmission will be stopped within 1 second, please refer to the “15.231(a)(1).pdf”.

2.3 Test equipment

Equipment	Brand	Frequency range	Model No.	Intertek ID No.	Next Cal. Date
EMI Test Receiver	Rohde & Schwarz	9kHz~2.75GHz	ESCS 30	EC303	04/13/2005
EMI Test Receiver	Rohde & Schwarz	20Hz~26.5GHz	ESMI	EC317	07/14/2005
Spectrum Analyzer	Rohde & Schwarz	9kHz~30GHz	FSP 30	EC353	07/13/2005
Spectrum Analyzer	Rohde & Schwarz	20Hz~40GHz	FSEK 30	EC365	10/19/2004
Horn Antenna	EMCO	1GHz~18GHz	3115	EC338	09/18/2005
Horn Antenna	SCHWARZBECK	14GHz~40GHz	BBHA 9170	EC351	07/08/2005
Bilog Antenna	SCHWARZBECK	25MHz~1.7GHz	VULB 9160	EC368	05/20/2005
Pre-Amplifier	MITEQ	100MHz~26.5GHz	919981	EC373	4/14/2005
Pre-Amplifier	MITEQ	26GHz~40GHz	828825	EC374	1/29/2005
Controller	HDGmbH	N/A	HD 100	EP317-1	N/A
Antenna Tower	HDGmbH	N/A	MA 240	EP317-2	N/A
Turn Table	HDGmbH	N/A	DS 420S	EP317-3	N/A
Signal Generator	Rohde & Schwarz	20MHz~27GHz	SMR27	EC354	08/18/2005
Power Meter / Sensor	Boonton	30MHz~8GHz	4231A / 51011-EMC	EC359	03/21/2005
Crystal Detector	Agilent	10MHz~18GHz	8472B	EC395	09/02/2005
Two Channel Digital Storage Oscilloscope	Tektronix	N/A	TDS1012	EC394	08/16/2005
LISN	Rohde & Schwarz	9KHz~30MHz	ESH3-Z5	EC344	01/14/2005

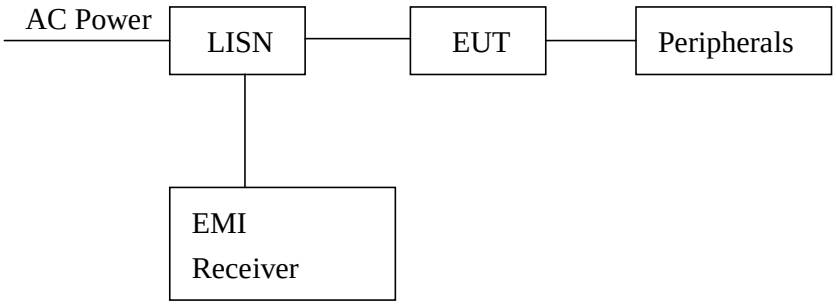
Note: The above equipments are within the valid calibration period.

3. Conducted emission test FCC 15.207

3.1 Operating environment

Temperature:	23	℃	(10-40℃)
Relative Humidity:	55	%	(10-90%)
Atmospheric Pressure	1023	hPa	(860-1061hPa)

3.2 Test setup & procedure



The EUT are connected to the main power through a line impedance stabilization network (LISN). This provides a 50 ohm/50uH coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm/50uH coupling impedance with 50ohm termination.
Both sides (Line and Neutral) of AC line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.4/1992 on conducted measurement.
The bandwidth of the field strength meter (R & S Test Receiver ESCS 30) is set at 9kHz.

3.3 Emission limit

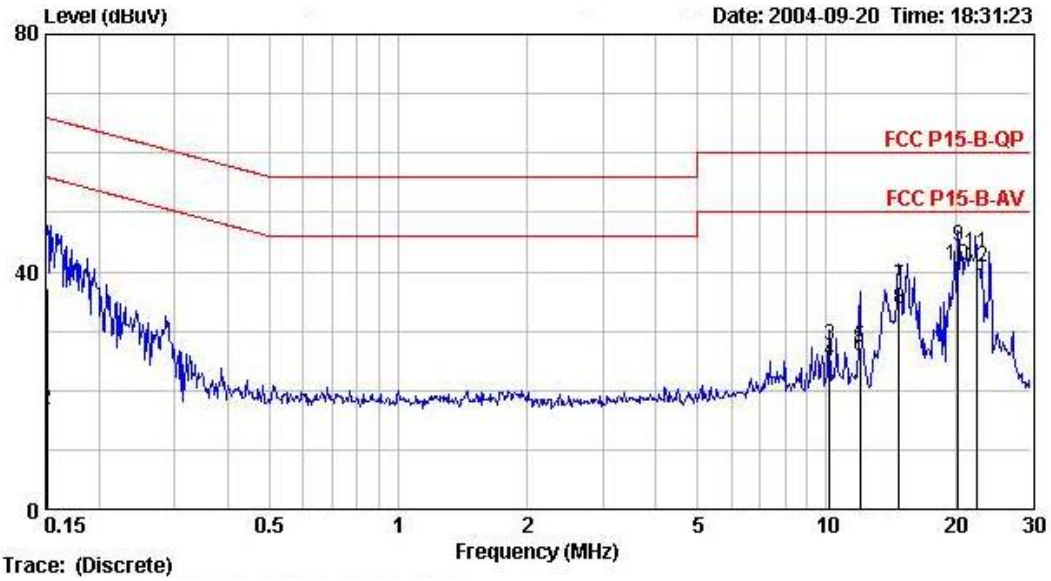
Freq. (MHz)	Maximum RF Line Voltage			
	Class A (dB μ V)		Class B (dB μ V)	
	Q.P.	Ave.	Q.P.	Ave.
0.15~0.50	79	66	66~56	56~46
0.50~5.00	73	60	56	46
5.00~30.0	73	60	60	50

3.4 Conducted emission data FCC 15.207

Phase : Line
EUT : WL902
Test Case : Lamp 450W

Frequency (MHz)	Corr. Factor (dB)	Level Qp (dBuV)	Limit Qp (dBuV)	Level AV (dBuV)	Limit Av (dBuV)	Margin (dB) Qp	Margin (dB) Av
0.151	0.10	37.31	65.93	16.81	55.93	-28.62	-39.12
10.156	0.51	27.51	60.00	24.98	50.00	-32.49	-25.02
12.006	0.63	27.23	60.00	25.90	50.00	-32.77	-24.10
14.769	0.80	37.40	60.00	33.70	50.00	-22.60	-16.30
20.313	0.96	44.23	60.00	41.08	50.00	-15.77	-8.92
22.351	1.01	42.98	60.00	40.60	50.00	-17.02	-9.40

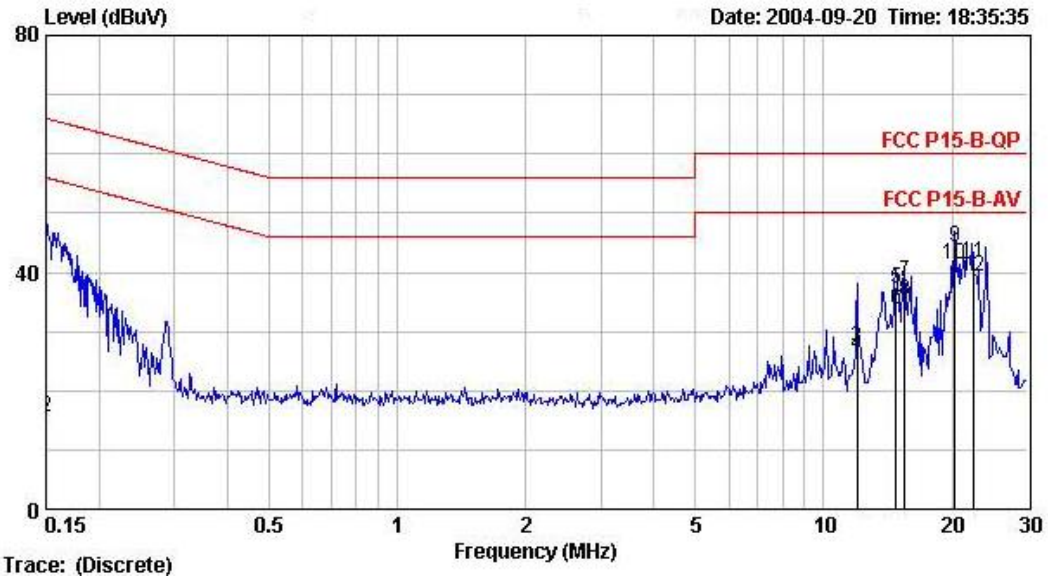
Remark:
1. Correction Factor (dB)= LISN Factor (dB) + Cable Loss (dB)
2. Margin (dB) = Level (dBuV) – Limit (dBuV)



Phase : Neutral
EUT : WL902
Test Case : Lamp 450W

Frequency (MHz)	Corr. Factor (dB)	Level Qp (dBuV)	Limit Qp (dBuV)	Level AV (dBuV)	Limit Av (dBuV)	Margin (dB) Qp	Margin (dB) Av
0.150	0.10	37.70	66.00	15.60	56.00	-28.30	-40.40
12.006	0.39	27.15	60.00	26.15	50.00	-32.85	-23.85
14.769	0.51	37.21	60.00	33.61	50.00	-22.79	-16.39
15.492	0.54	38.49	60.00	35.25	50.00	-21.51	-14.75
20.313	0.75	44.12	60.00	41.34	50.00	-15.88	-8.66
22.351	0.76	41.69	60.00	39.27	50.00	-18.31	-10.73

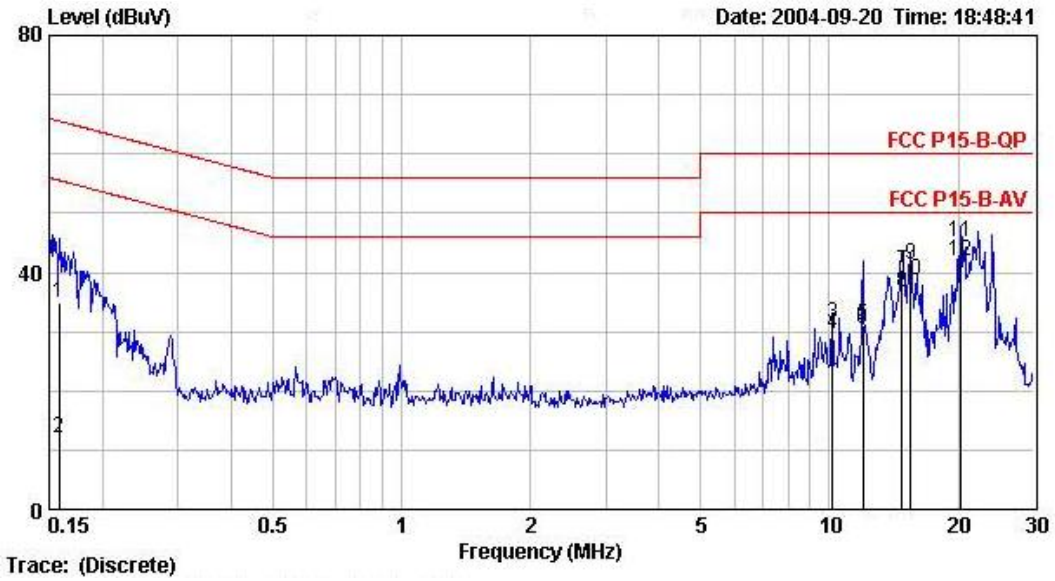
Remark:
1. Correction Factor (dB)= LISN Factor (dB) + Cable Loss (dB)
2. Margin (dB) = Level (dBuV) – Limit (dBuV)



Phase : Line
EUT : WL905
Test Case : Lamp 400W

Frequency (MHz)	Corr. Factor (dB)	Level Qp (dBuV)	Limit Qp (dBuV)	Level AV (dBuV)	Limit Av (dBuV)	Margin (dB) Qp	Margin (dB) Av
0.159	0.10	34.85	65.54	12.01	55.54	-30.69	-43.53
10.156	0.51	31.46	60.00	29.46	50.00	-28.54	-20.54
12.006	0.63	31.03	60.00	30.38	50.00	-28.97	-19.62
14.769	0.80	40.23	60.00	36.66	50.00	-19.77	-13.34
15.492	0.83	41.28	60.00	38.66	50.00	-18.72	-11.34
20.313	0.96	45.09	60.00	41.88	50.00	-14.91	-8.12

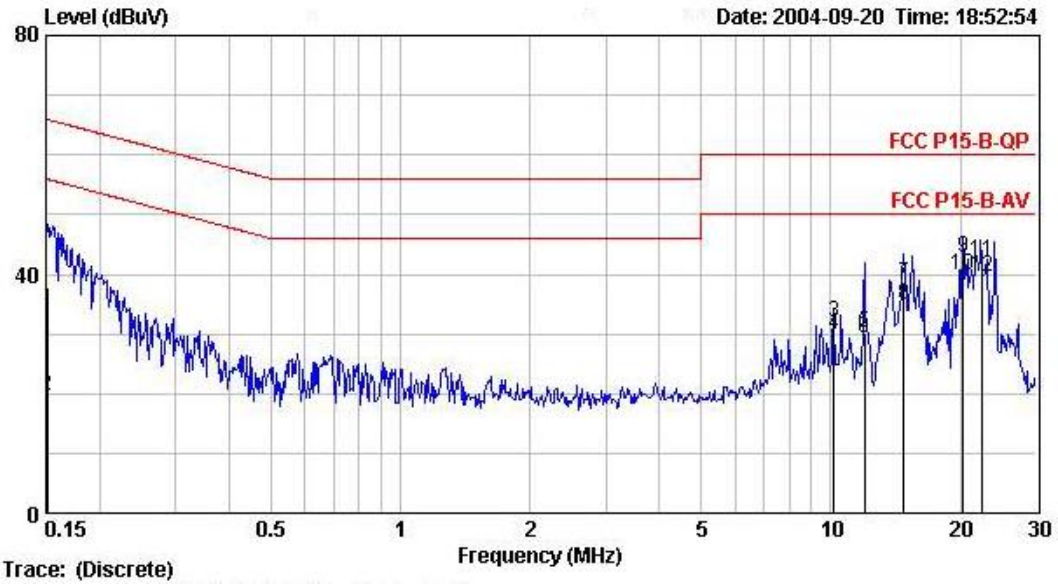
Remark:
1. Correction Factor (dB)= LISN Factor (dB) + Cable Loss (dB)
2. Margin (dB) = Level (dBuV) – Limit (dBuV)



Phase : Neutral
EUT : WL905
Test Case : Lamp 400W

Frequency (MHz)	Corr. Factor (dB)	Level Qp (dBuV)	Limit Qp (dBuV)	Level AV (dBuV)	Limit Av (dBuV)	Margin (dB) Qp	Margin (dB) Av
0.151	0.10	37.68	65.93	19.54	55.93	-28.25	-36.39
10.156	0.31	32.09	60.00	30.04	50.00	-27.91	-19.96
12.006	0.39	30.13	60.00	29.44	50.00	-29.87	-20.56
14.769	0.51	38.36	60.00	34.77	50.00	-21.64	-15.23
20.313	0.75	42.92	60.00	39.72	50.00	-17.08	-10.28
22.351	0.76	42.27	60.00	39.58	50.00	-17.73	-10.42

Remark:
1. Correction Factor (dB)= LISN Factor (dB) + Cable Loss (dB)
2. Margin (dB) = Level (dBuV) – Limit (dBuV)



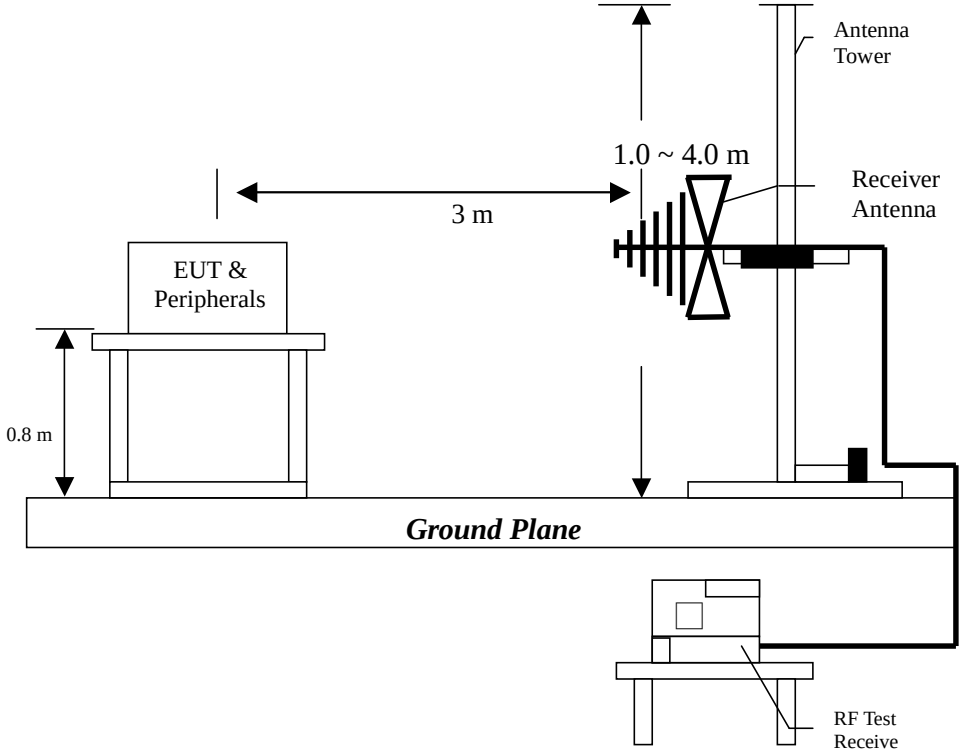
4. Radiated emission test FCC 15.231 (b)

4.1 Operating environment

Temperature:	22	℃	(10-40℃)
Relative Humidity:	52	%	(10-90%)
Atmospheric Pressure	1023	hPa	(860-1060hPa)

4.2 Test setup & procedure

The Diagram below shows the test setup, which is utilized to make these measurements.



Radiated emission measurements were performed from 30MHz to 25GHz. Spectrum Analyzer Resolution Bandwidth is 100kHz or greater for frequencies 30MHz to 1GHz, 1MHz – for frequencies above 1GHz.
The EUT for testing is arranged on a wooden turntable. If some peripherals apply to the EUT, the peripherals will be connected to EUT and the whole system. During the test, all cables were arranged to produce worst-case emissions. The signal is maximized through rotation. The height of antenna and polarization is changing constantly for exploring for maximum signal level. The height of antenna can be up to 4 meters and down to 1 meter.

The measurement for radiated emission will be done at the distance of three meters unless the signal level is too low to measure at that distance. In the case of the reading under noise floor, a pre-amplifier is used and/or the test is conducted at a closer distance. And then all readings are extrapolated back to the equivalent three meter reading using inverse scaling with distance.

The signal is maximized through rotation and placement in the three orthogonal axes.

Setup 1

Setup 2

Setup 3

After verifying three axes, we found the maximum electromagnetic field was ccurred at setup 2 configuration. The final tset data was executed under this configuration.

The EUT configuration please refer to the “Spurious set-up photo.pdf”.

4.3 Radiated emission limit

4.3.1 Fundamental and harmonics emission limits

Frequency (MHz)	Field Strength of Fundamental		Field Strength of Harmonics	
	(uV/m@3m)	(dBuV/m@3m)	(uV/m@3m)	(dBuV/m@3m)
315MHz	6041.68	75.62	604.17	55.62

4.3.2 General radiated emission limit

The spurious Emission shall test through the 10th harmonic. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a).

Frequency MHz	15.209 Limits (dB μ V/m@3m)
30-88	40
88-216	43.5
216-960	46
Above 960	54

Remark:
1. In the above table, the tighter limit applies at the band edges.
2. Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system

Uncertainty was calculated in accordance with NAMAS NIS 81.
Expanded uncertainty (k=2) of radiated emission measurement is ±3.078 dB.

4.4 Calculation of Average Factor

The specification for output field strengths in accordance with the FCC rules specify measurements with an average detector. During testing, a spectrum analyzer incorporating a peak detector was used. Therefore, a reduction factor can be applied to the resultant peak signal level and compared to the limit for measurement instrumentation incorporating an average detector.

The time period, over which the duty cycle is measured in 50 ms or the repetition cycle, whichever is a shorter time frame. The duty cycle is measured by placing the spectrum analyzer in zero span mode at 100KHz resolution bandwidth.

Averaging factor in dB = 20log (duty cycle)

The duty cycle is simply the on-time divided by the period:

The duration of one cycle = 361.13 ms

The number of short pulses in each period (54) multiplied by the duration of each short pulses (0.902ms) = 48.708ms

The number of long pulses in each period (14) multiplied by the duration of each long pulses (3.98ms) = 55.72ms

Effective period of the cycle = 48.708 + 55.72 = 104.428 ms

DC = 104.428 ms / 361.13 ms = 0.2892

Therefore, the averaging factor is fond by 20 log10 0.2892 = -10.78 dB

Please see the Average Factor plot as file name “Average Factor plot.pdf”.

4.5 Radiated emission test data FCC 15.231

4.5.1 Measurement results: frequencies equal to or less than 1 GHz

EUT : WL901
Worst Case : Tx at channel 1 with setup 2 configuration

Frequency (MHz)	Spectrum Analyzer Detector	Antenna Polariz. (H/V)	Correction Factor (dB/m)	Reading (dBuV)	Average Factor (dB)	Corrected Level (dBuV)	Limit @ 3 m (dBuV)	Margin (dB)	Antenna high (cm)	Turn Table angle (degree)
315.040	PK	V	14.45	49.32	-10.78	52.99	75.62	-22.63	353.00	83.00
315.040	PK	H	14.45	61.08	-10.78	64.75	75.62	-10.87	100.00	322.00

Remark:
1. Corrected Level = Reading Level + Correction Factor + Average Factor
2. Correction Factor = Antenna Factor + Cable Loss

EUT : WL901
Worst Case : Tx at channel 1 with setup 2 configuration

Frequency (MHz)	Spectrum Analyzer Detector	Antenna Polariz. (H/V)	Correction Factor (dB/m)	Reading (dBuV)	Average Factor (dB)	Corrected Level (dBuV)	Limit @ 3 m (dBuV)	Margin (dB)	Antenna Heigh (Meter)	Turn Table (Degree)
399.950	PK	V	16.70	13.62	-10.78	19.54	55.62	-36.08	145.00	20.00
485.970	PK	V	18.61	13.41	-10.78	21.24	55.62	-34.38	108.00	114.00
630.100	PK	V	21.48	33.71	-10.78	44.41	55.62	-11.21	103.00	110.00
765.170	PK	V	23.58	12.94	-10.78	25.74	55.62	-29.88	159.00	217.00
870.110	PK	V	24.23	12.84	-10.78	26.29	55.62	-29.33	201.00	28.00
945.150	PK	V	25.35	27.61	-10.78	42.18	55.62	-13.44	151.00	290.00
480.170	PK	H	18.61	12.25	-10.78	20.08	55.62	-35.54	174.00	125.00
524.810	PK	H	19.15	12.74	-10.78	21.11	55.62	-34.51	215.00	101.00
630.100	PK	H	21.48	32.33	-10.78	43.03	55.62	-12.59	267.00	17.00
712.810	PK	H	22.84	14.72	-10.78	26.78	55.62	-28.84	54.00	210.00
794.410	PK	H	23.95	13.39	-10.78	26.56	55.62	-29.06	174.00	313.00
945.160	PK	H	25.35	33.51	-10.78	48.08	55.62	-7.54	107.00	168.00

Remark:
1. Corrected Level = Reading Level + Correction Factor + Average Factor
2. Correction Factor = Antenna Factor + Cable Loss

EUT : WL902
Test Case : Lamp 450W

Frequency (MHz)	Spectrum Analyzer Detector	Antenna Polariz. (H/V)	Correction Factor (dB/m)	Reading (dBuV)	Corrected Level (dBuV)	Limit @ 3 m (dBuV)	Margin (dB)	Antenna high (cm)	Turn Table angle (degree)
59.980	QP	V	13.07	19.62	32.69	40.00	-7.31	100.00	239.00
163.980	QP	V	14.92	16.22	31.14	43.50	-12.36	100.00	107.00
316.600	QP	V	14.74	8.85	23.59	46.00	-22.41	198.00	166.00
633.230	QP	V	21.48	11.29	32.77	46.00	-13.23	100.00	39.00
747.810	QP	V	23.39	11.72	35.11	46.00	-10.89	100.00	0.00
848.770	QP	V	24.19	13.04	37.23	46.00	-8.77	100.00	0.00
165.980	QP	H	14.92	13.81	28.73	43.50	-14.77	251.00	92.00
316.600	QP	H	14.74	12.41	27.15	46.00	-18.85	130.00	117.00
633.220	QP	H	21.48	17.46	38.94	46.00	-7.06	150.00	323.00
703.210	QP	H	22.14	11.72	33.86	46.00	-12.14	100.00	0.00
784.710	QP	H	23.61	12.04	35.65	46.00	-10.35	100.00	0.00
852.610	QP	H	24.52	11.84	36.36	46.00	-9.64	100.00	0.00

Remark:
1. Corrected Level = Reading Level + Correction Factor
2. Correction Factor = Antenna Factor + Cable Loss

EUT : WL905
Test Case : Lamp 400W

Frequency (MHz)	Spectrum Analyzer Detector	Antenna Polariz. (H/V)	Correction Factor (dB/m)	Reading (dBuV)	Corrected Level (dBuV)	Limit @ 3 m (dBuV)	Margin (dB)	Antenna high (cm)	Turn Table angle (degree)
35.980	QP	V	12.67	12.21	24.88	40.00	-15.12	119.00	360.00
127.150	QP	V	12.89	17.45	30.34	43.50	-13.16	104.00	204.00
227.980	QP	V	11.82	19.81	31.63	46.00	-14.37	152.00	108.00
316.620	QP	V	14.74	16.37	31.11	46.00	-14.89	140.00	269.00
584.880	QP	V	20.62	14.81	35.43	46.00	-10.57	201.00	214.00
633.250	QP	V	21.48	12.38	33.86	46.00	-12.14	127.00	329.00
127.810	QP	H	12.89	21.81	34.70	43.50	-8.80	154.00	107.00
214.350	QP	H	11.56	26.14	37.70	43.50	-5.80	105.00	54.00
233.710	QP	H	12.41	25.71	38.12	46.00	-7.88	201.00	168.00
316.610	QP	H	14.74	17.18	31.92	46.00	-14.08	134.00	200.00
357.810	QP	H	15.60	23.17	38.77	46.00	-7.23	117.00	157.00
633.250	QP	H	21.48	12.51	33.99	46.00	-12.01	134.00	265.00

Remark:
1. Corrected Level = Reading Level + Correction Factor
2. Correction Factor = Antenna Factor + Cable Loss

4.5.2 Measurement results: frequency above 1GHz

EUT : WL901
Worst Case : Tx at channel 1 with setup 2 configuration

Frequency (MHz)	Spectrum Analyzer Detector	Antenna Polariz. (H/V)	Correction Factor (dB/m)	Reading (dBuV)	Average Factor (dB)	Corrected Level (dBuV)	Limit @ 3 m (dBuV)	Margin (dB)	Antenna high (cm)	Turn Table angle (degree)
1260.230	PK	V	27.04	15.33	-10.78	31.59	55.62	-24.03	122.00	266.00
*1575.280	PK	V	28.54	10.07	-10.78	27.83	54.00	-26.17	100.00	9.00
1260.230	PK	H	27.04	21.65	-10.78	37.91	55.62	-17.71	107.00	174.00
*1575.280	PK	H	28.54	9.54	-10.78	27.30	54.00	-26.70	171.00	166.00

Remark:
1. Corrected Level = Reading Level + Correction Factor + Average Factor
2. Correction Factor = Antenna Factor + Cable Loss
3. "*" means the emission within the restricted band meets the requirement of part 15.205. The corresponding limit as per 15.209.
4. The frequency measured ranges from 1GHz to 25GHz.The data value listed above which is higher than the noise floor, the others please refer to noise floor level.

For PK:
1GHz-3GHz: 50dBuV
3GHz-14GHz: 54dBuV
14GHz-26.5GHz: 60dBuV

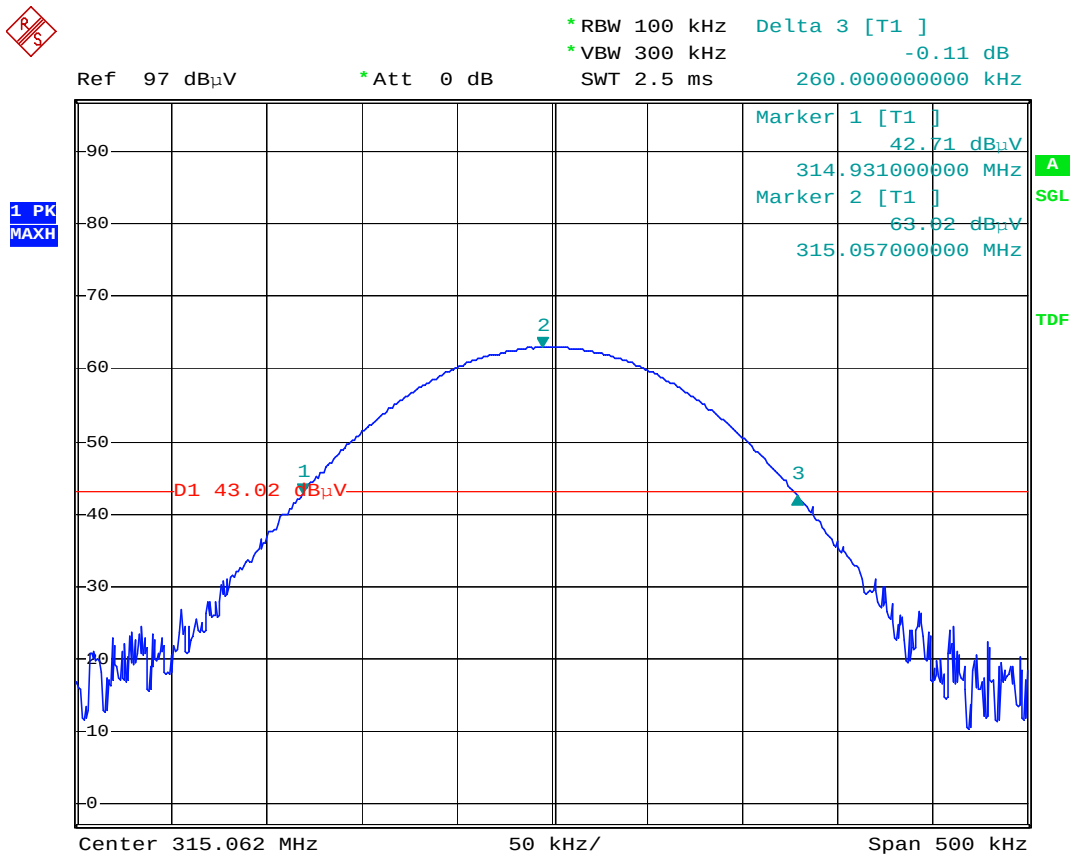
For AV:
1GHz-3GHz: 41.5dBuV
3GHz-14GHz: 46dBuV
14GHz-26.5GHz: 46.5dBuV

4.6 Measured bandwidth FCC 15.231(C)

The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70MHz and below 900MHz. Bandwidth is determined at the points 20dB down from the modulated carrier.

B.W(20dBc) Limit = 0.25% × f(MHz) = 0.25% × 315MHz = 0.7875MHz

From the plot, the bandwidth is observed to be 315MHz, at 20dBc where the bandwidth limit is 0.7875MHz. and the plot showed below.



Comment: 20dB Bandwidth
Date: 20.SEP.2004 15:55:45